

CROP TALK

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Taking Steps Towards Reducing The Risk To Pollinators

by Tracey Baute – Field Crop Entomologist and Greg Stewart – Corn Specialist, OMAF and MRA

Many growers are asking what actions they can take to help reduce the risk of bee kills this spring during corn planting. Check out http://fieldcropnews.com/2013/01/taking-steps-towards-reducing-the-risk-to-pollinators/ for the best recommendations we can provide at this time.

Zero In On Canola Seeding Rates

by Brian Hall, Canola & Edible Bean Specialist, OMAF and MRA

Establishment is often the greatest challenge in growing canola. Either over or under seeding can be a costly mistake. Under low plant populations, plants will stand well, have large stalks and branch more, but yields are compromised because there are less of them. At the other end of the scale, overcrowding results in greater risk of sclerotinia and lodging, cutting into yields.

While the 'average' seeding rate is likely 4.5 – 5 lbs/ac, some growers have trimmed that back to 3.5 pounds. Others feel they are getting their best yields by pushing seeding rates up to 6-7 lb/ac. In the 2012 Ontario Canola Challenge Contest, a couple of the winners seeded at 7 lb/ac. They cited more uniform stands, with plants that branch less, flower and mature more uniformly, with thinner stalks that allow for easier combining.

Canola's Problem – High Seedling Mortality

Research by the Canola Council of Canada shows that under average field conditions, canola seedling emergence is typically only 40 to 60%. Multiple factors are responsible for this high mortality. Canola's small seed size means that once germination begins, it has limited food reserves on which to survive. Canola has a limited ability to emerge if sown deeper than 2.5 cm (1 inch). Emergence of seed sown at 3.8 cm (1.5 inches) is only 50 - 60% of that sown at the optimum depth of 1.3 – 2.5 cm (0.5 - 1 inch).

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Soil moisture is by far the biggest factor affecting seedling mortality and final emergence. Field surveys show dry soil conditions at seeding and during the following week increase seedling mortality by 10 - 50%. Seedling mortality increases significantly when seeds start to germinate, but wither out because of lack of soil moisture.

Fine Tune 'Optimum' Seeding Rate

There is no one seeding rate. Weather factors, soil type, seeding equipment and planting date are all factor determining a target seeding rate for each field. In 2012, many growers ended up with lower than normal plant stands because of weather and soil conditions. Early seeded stands suffered from repeated frosts, cold weather and flea beetles. Later planted stands emerged unevenly due to dry soil conditions, and were also affected by flea beetles.

In determining optimum seeding rates, it helps to begin with the desired final plant stand. In canola the optimum plant stand is 7 – 10 healthy plants / square foot (ft^2). A minimum is 5 plants/ft^2. In 7.5 inch rows this is equivalent to 4.5 to 6 plants per foot of row. Target seeding rates need to account for large differences in seed size between varieties *and* seed lots. Under good seeding conditions, a 75% emergence rate is reasonable. Under average conditions, a 60% emergence rate is a reasonable reference point to calculate seeding rates.

Seeding rates need to be based on the 1,000 kernal seed weight (grams per thousand seeds). Table 1 shows target seeding rates based on 8 plants/ft^2 final plant stand and either 75% or 60% emergence. For example, under average soil conditions seed with 90% germination rating and 32% seedling mortality would result in 60% final emergence. The seeding rate for seed with 5 gm /1000 seed weight is 6.3 lb/ac at 60% emergence. The final two columns in the table show the grams of seed per opener for 100 foot travel distance. This can be helpful in calibrating your drill. Finally, check the actual plant stands 3 - 4 weeks following emergence in each field, so you can make adjustments next season.

Checking Conventional Drill Calibration

Once the appropriate seeding rate has been determined, check that seeding equipment is properly calibrated to deliver the desired pounds of seed per acre. Consult the operator's manual for recommended calibration instructions, or follow this procedure:

- Measure out 100 feet. An alternate way without driving the 100 feet is to jack up the end of the drill with the drive wheel, and turn the wheel the number of times to equal 100 ft.
- Collect the seed from individual openers over this distance. Check several openers across the drill to ensure each run is accurate. If you are not sure where to begin to set seed cup openers, start with the width of 3 dimes. Weigh the collected seed.
- Refer to Table 1 for correct grams of seed for either 60% or 75% final emergence in 7.5 inch rows.
- For other row widths, use this formula:
  Grams of seed ÷ number of drill runs collected ÷ row spacing (inches) x 12 = seeding rate (lb. /ac.)
  For example, if the grower collects 7.8 g from 3 drill runs and row spacing is 6 inches, then the actual seeding rate is 7.8 ÷ 3 ÷ 6 x 12 = 5.2 lb /ac (6.5 seeds per foot of row).
- Record seeding rate and drill settings for next year!

A calculator for seeding rates can be found on Alberta Agriculture website:
http://www.agric.gov.ab.ca/app19/calc/crop/otherseedcalculator.jsp

Table 1 - Target Seeding Rates

CANOLA SEEDING RATE (lb/ac)				
1,000 Seed Weight (grams)	Target Seeding Rate lb/acre		Grams of Seed per opener per 100 feet (30.5 m) of travel (7.5 inch rows)	
	75% Emergence	60% Emergence	75% Emergence	60% Emergence
	6.7 Seeds per foot of row	8.2 Seeds per foot of row		
2.5	2.6	3.1	1.7	2.0
3	3.1	3.8	2.0	2.5
3.5	3.6	4.4	2.3	2.9
4	4.1	5.0	2.7	3.3
4.5	4.6	5.6	3.0	3.7
5	5.1	6.3	3.3	4.1
5.5	5.7	6.9	3.7	4.5
6	6.2	7.5	4.0	4.9
6.5	6.7	8.2	4.4	5.3

Bulking Of Seed

Bulking seed with MAP (11-52-0), MicroEssentials S15 (15-0-0-15S) pelletized sulphur or corn cob grits are options for improving seeding rate accuracy (Figure 1). Seeding through the grass seed box is another option, with the seed tubes inserted into the disc openers. Some drill manufacturers also offer one-half speed drive sprockets. It is important to note in using Micro essentials S15, that only one half of the sulphur analysis is available in the year of application. Also note that canola research has shown a benefit of seed placed phosphorus, this has not been demonstrated for sulphur.

Figure 1 – Seed Bulking

Pelletized sulphur (top left), MAP with seed (bottom right), seed alone (bottom left)

Double Cropping Soybeans

by Horst Bohner, Soybean Specialist, & Dan Docking, OMAF and MRA

Some Ontario soybean producers are considering the feasibility of double cropping soybeans after cereals. Over the past few years, cereal harvests have been early and late season growing conditions have been excellent. However, there has been relatively little research conducted in Ontario to determine best management practices for double cropped soybeans.

Risks

Dry conditions during mid-summer seeding can be a challenge in plant establishment. The biggest difficultly to double cropping soybeans is the risk of an early fall frost. If temperatures fall low enough, the soybean plant will shut down. If this frost occurs before seeds have been formed in the pods, there is nothing to harvest.

2012 Trials

In order to provide useful recommendations for double cropping soybeans in Ontario, an OMAFRA project was undertaken to test management practices to increase the likelihood of a successful crop. The initial study was to determine optimum seeding rates for double crop success (100,000, 200,000 and 300,000 seeds per acre) and to test the appropriate maturity (variety) to seed. Each of these treatments were randomized and replicated three times at a field scale in three separate trial locations.

Figure 1. Planting soybeans into winter barley stubble (left) took place on July 11, 2012 in very dry conditions near Mitchell.

In 2012, trials were planted at three locations, two in Perth County near Mitchell, and one in Middlesex County, near Lucan. The Bornholm site was planted on July 11 after winter barley. The other two sites were planted on July 23 and 24 after winter wheat (Figure 1). There was a slight delay at the two later planted sites because of the need to remove straw. As a result, only the early-planted Bornholm site, planted July 11, made it to yield and was harvested November 23. The other two sites did not make enough yield to warrant combining due to an early October frost.

At the site that was harvested, two varieties were planted. Variety A had a CHU rating of 2,650 or a relative maturity of 0.4. Variety B had a CHU rating of 2750 or a relative maturity of 0.8. Variety A was approximately 100 CHU "shorter" than an adapted variety for the planting area. Only Variety A was used in the seeding rate experiment. The results are in Table 1.

Table 1 - Double Crop Yield for Variety A at Various Seeding Rates (2012, 1 Site)

Treatment	Average Yield (bu/ac)	Yield Advantage (bu/ac)
Variety A (100 000 seeds)	18.0	-
Variety A (200 000 seeds)	20.6	2.6
Variety A (300 000 seeds)	23.4	5.4

As the results show, by increasing the number of seeds planted, yield was increased substantially. This trend relates well to other seeding rate trials conducted in the past. In this study, by increasing the seeding rate from 100,000 seeds/acre to 300,000 seeds/acre, yield was increased by 5.4 bushels per acre.

Variety B was an adapted soybean variety for the area, versus the shorter day Variety A (100 CHU less). In this case, there was little yield difference between the two varieties. In future trials, a larger CHU difference will be compared to assess any possible yield gains from planting shorter maturing varieties.

Frost Damage

Figures 2 and 3 illustrate the risk that has always limited the number of double crop soybean acres in Ontario. The past year provided an opportunity to try double cropping because of the early cereal harvest. However, an early October frost was enough to kill the crop, so that there was no yield in some cases. The later the soybeans are planted, the higher the risk of crop failure due to frost.

Figures 2 : A soybean plant killed by frost (left), the beans were planted July 23 and frost occurred in early October.

Figure 3: Soybean seed in the pod was not fully developed at the time of the killing frost

Bottom Line

The initial findings of this study show that higher seeding rates will increase soybean yields when double cropping, which parallels other seeding rate findings. The most critical component of double crop success is seeding immediately after cereals are harvested. Any delays due to straw removal, can lead to a complete crop loss and zero return on investment due to a killing frost.

Wheat Lodging Concerns

By Peter Johnson, Cereal Specialist, OMAF and MRA

The 2013 wheat crop is at high risk! 80% of the wheat crop was planted earlier than normal last fall. The good news is early planting leads to higher yield potential. The bad news is it increases the risk of lodging. Practice the following management techniques to reduce the chance of lodging this year.

Planting Date

Lodging potential is increased with early planting. Early planted fields have denser canopies and can have weaker stems. You need to plant early for high yield, but recognize these fields will have the highest risk to go flat.

Seeding Rates

Growers are LOATH to reduce seeding rates. But high plant populations, especially combined with early seeding, dramatically increase lodging risk! What was your seeding rate last fall? Did you vary it by planting date? Early seeded wheat should have the population reduced at least 25% from normal, and up to 40% reduction is quite acceptable. Seeded early at a high seeding rate? Watch out!

Variety

As we push nitrogen (N) rates higher to increase yield, it will become more and more critical to select varieties with good stand ability. High yield does not materialize when the wheat has to be scraped off the ground.

Nitrogen

Nitrogen drives yield (and protein)! We have harped for the last 5 years to increase N rates. However, producers are warned to proceed with caution. Although lodging has not been an issue in the past several years, increase N rates by 30 lbs/ac in strips until you are comfortable that lodging is manageable.

Nitrogen Application Time

Split N applications can reduce lodging potential. Stand ability is improved by avoiding too much available N right at stem elongation. Consider applying one-third of your N as early as possible in the spring, followed by two-thirds at second node (Growth Stage 32), rather than all in one application at our normal late-April application time.

Slow Release Products

Products like ESN® can have the same result as a split application in terms of lodging impact. Research has shown that ESN reduces lodging. However in Ontario trials, it has not increased yield. Agrotain® and Agrotain Plus® have not been evaluated recently for lodging impacts. My best guess is that lodging will not be significantly affected with these products but we will do the research to see.

Fungicides

Research shows that early fungicides have a minor effect in improving stand ability. Fungicides are an essential part of a "high nitrogen" driven yield goal. An added plus is their effect on stem integrity will add slightly to lodging resistance.

Temperature

Watch spring temperatures! Excessive growth due to warm wet weather during stem elongation can increase lodging potential. Wheat likes temperatures of 18ºC daytime and 10ºC night. If nights are much warmer (i.e. 20ºC), thinner stems will result and cause increased lodging.

Plant Growth Regulators (PGR)
Plant growth regulators are used for lodging control in most other high yield cereal growing regions. The PGR reduces lodging by shortening internodes and thickening stem walls. These thicker stems better resist lodging pressures. New PGR's are in the pipeline in Ontario. Hopefully by 2014 more options will be available.

After 5 years of very little lodging, 2013 could be the disaster year. Do everything you can to aim for high yield wheat, but manage those crops to avoid lodging. We need to continue to push for YIELD, but combining flat wheat will not get us there!

Controlled Grazing Guidelines

By Jack Kyle, Grazing Specialist, OMAF and MRA

The success of any grazing program or system is very much dependent on how the pasture is managed throughout the year. Giving the grasses and legumes in the pasture the opportunity to grow and accumulate energy for your livestock to consume is the key. The best way to do this is to have some control over where the livestock is grazing. This is accomplished by fencing and rotating between pastures/paddocks throughout the grazing season.

Don't Start Too Early
Starting too early in the spring will set the growth back for the whole season. Wait until the grass plants have developed 2 full leaves and the 3rd leaf is visible. This will be at 10-15 cm (4-6 inches) on blue grass and 15-20 cm (6-8 inches) on orchard grass, brome grass etc. If you are grazing alfalfa based pastures, wait until the alfalfa is showing some buds, and be prepared to manage bloat risk.

Graze "Fast" on First Pass
The second step is to graze "fast" once you start in the spring. May growth is very explosive and can get ahead of the livestock. To avoid this, rotate quickly from one pasture to the next. Don't be concerned about how much grass is being left behind. This grass will continue to photosynthesize and produce more grass that will be available for subsequent grazings later in the season. By "topping" the grass on the first pass you will delay its maturity and maintain lush quality forage in the pasture.

Maintain Short Grazing Periods
Step three is to keep the grazing period in any paddock to less than 5-6 days (ideally 1 day). Grasses start to re-grow a few days after being grazed. This new growth is very palatable and will be readily eaten as soon as it emerges. This "re-grazing" will significantly slow any subsequent re-growth. The longer animals are on a pasture, the more the plants will have been fouled by manure, urine, walked on or laid on. These plants will not be readily consumed, which reduces the amount of available forage.

Adequate Rest and Recovery
Step four is to allow adequate rest and recovery time for your pastures once they are grazed. By maintaining a 10-15 cm (4-6 inch) residual in the pasture, plants will be able to maintain active growth and be ready for the next grazing much sooner. In southern Ontario, managed pastures are providing 5-6 grazings and suffer less impact from poor growing conditions during July and August.

Temporary or semi-permanent electric fence is easy to erect and will allow you to have control of your grazing livestock to maximize productivity. By following these basic steps, a producer will realize a significant increase in pasture productivity.

Chickweed Infesting An Alfalfa Crop - What To Do?

by Mike Cowbrough, Weed Specialist, OMAF and MRA

How do you control chickweed in alfalfa? This is a common problem in hayfields. If you don't know what chickweed is, search it on google images. Of course there is always www.weedinfo.ca. (Figure 1)

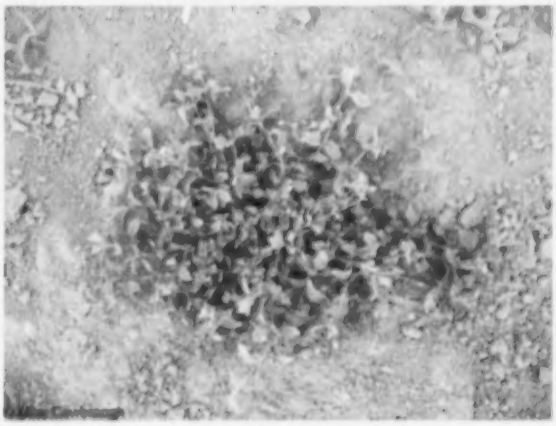

Figure 1 – Mature chickweed in May.

There are three main points on chickweed infesting an alfalfa crop:

- Any herbicide that is effective at controlling chickweed will either significantly damage the alfalfa and/or whatever forage grass is planted (e.g. timothy).
- Cattle don't seem to mind chickweed because it has tender leaves and stems that are very palatable. The nutritive value is typically quite good. (Note - I'm not a ruminant nutritionist.)
- A rotational plan to reduce seed production of chickweed is needed to lower populations. This will involve effective residual herbicides in rotational crops and cover crops that reduce chickweed seed recruitment. (Don't worry, I'll be more specific....read on)

Emergence Patterns and Seed Production of Chickweed in Alfalfa

A report from the North Eastern Weed Conference proceeding in 1953 details the emergence, flowering and seed germinating patterns over a year in an alfalfa field:

> "Chickweed plants were observed in the blooming and seed producing stages from September through June at Storrs, Connecticut, in 1952. Seed germinated in the field from April until November wherever the surface soil was moist. On July 18, a count of chickweed seed present on the plants and scattered on the soil surface indicated that over **24,000 seeds per square foot** were produced."

That's over a billion seeds per acre! No wonder some call it carpet weed. The study also conducted a germination experiment which indicated that the seed germinated best at soil temperatures of 15°C.

Herbicide Activity on Chickweed in Alfalfa

There are no herbicides registered in Eastern Canada that are labelled to control chickweed in alfalfa. Pursuit (imazethapyr) has excellent activity on chickweed and can be used to control weeds in solid stand alfalfa that is used for seed production. However, Pursuit is not registered for forage alfalfa. Peter Sikkema conducted a trial in 2002, where 100 ml/ac of Pursuit applied to alfalfa in the fall provided chickweed control above 90% the following spring. I have used imazethapyr in research demonstration trials targeting weeds in an alfalfa/timothy crop in the spring, and although it works well, it will severely injure forage grasses in the stand.

According to Arregui et al., 2001 flumetsulam (Broadstrike RC) has been recommended for the control of common chickweed in alfalfa, which is not controlled by 2,4-DB. Kraus et al., 2003 also reported that Broadstrike RC at 56 g ai/ha provided 98% control of mouse-eared chickweed initially, but after 4 weeks control was reduced to 50% , presumably due to the germination of new seeds. It should be noted that while Arregui et al., 2001 and others have observed good alfalfa tolerance to flumetsulam, this product is not registered for use on alfalfa in Canada and therefore such use would be illegal.

Nutritive Value of Alfalfa To Livestock

Look no further than Lee Allen Peterson's Edible Wild Plants for the culinary virtues of chickweed. However, from a forage point of view would it be problematic to feed chickweed to livestock? That clearly is a question for your livestock nutritionist. In 2008, while doing a weed survey in forage crops I randomly sent weed specimens to a diagnostic lab. The results of the analysis of chickweed are in Figure 2. When I have shown this to various ruminant nutritionists, their response has been positive on the feed quality of chickweed.

Long Term Management Strategy

Objective: reduce capacity of chickweed to compete, flower and produce new seed.

Step # 1 – The use of effective herbicides in other crops in the rotation that provide some residual control to inhibit new seed germination (Table 1).
Most residual herbicides will provide between 4-8 weeks of residual control. Both glyphosate (e.g. Roundup) and Liberty (glufosinate) are effective (and labelled) for the control of chickweed in their respective herbicide tolerant crops, but offer no residual control. Any wheat herbicide that is effective on chickweed offers very little residual control. However the high plant density of winter wheat is effective at shading and inhibiting further seed germination.

Step # 2 - Cover crops will be an important tool to reduce seed recruitment after the main crop is harvested. Recent University of Guelph research has demonstrated that a mixture of oilseed radish and rye generally has provided the best suppression of weeds.

Figure 2 – Lab results for feed analysis of chickweed (Stellaria media).

Date Received: 04-Jul-2008
Date Printed: 08-Jul-2008

Lab No.: 8615901 Feed Type: misc. mixed feeds
Sample: 1 - Chickweed Test Type: AFL TMR Excel Basic

Test	Dry Basis	As Is	Test	Dry Basis	As Is
Dry Matter %		11.98	ENERGY		
Moisture		88.02	TDN (estimated)%	75.29	9.02
PROTEIN			Net Energy (lac) MCAL/kg	1.52	0.18
Protein % (N X 6.25)	17.57	2.10	Net Energy (gain) MCAL/kg	1.30	0.16
FIBRES			Net Energy (maint) MCAL/kg	1.95	0.23
Acid Detergent Fibre %	22.60	2.71	OTHER		
Neutral Detergent Fibre %	34.20	4.10	WTDN	81.39	9.75
MINERALS			WNEL	1.89	0.23
Calcium %	0.81	0.10	WNEG	1.06	0.13
Phosphorus %	0.54	0.07	WNEM	1.78	0.21
Potassium %	5.62	0.67			
Magnesium %	0.50	0.06			
Sodium %	0.09	0.01			

Table 1 - Herbicides effective at controlling chickweed		
Corn	**Soy-bean**	**Wheat**
Aatrex 480	Optill	Refine SG
Callisto + Aatrex 480	Pursuit, Phan-tom	Refine M
Con-verge XT	Prowl H2O	Trophy
Marks-man	Sencor	
	Valtera	

Maintain 30% Soil Cover All Year Long!

By Adam Hayes, Soil Management Specialist - Field Crops, OMAF and MRA

Rising land prices make it more important than ever to protect our soils from erosion and keep organic matter levels at optimum levels. Soil erosion can cost up to $10 per ton of lost soil per acre, reduce yields by up to 50% and cost up to $40 per acre in drain maintenance and other costs. Soil productivity can be easily maintained by providing at least 30% soil cover with crops, residues or cover crops throughout the year. **A wide range of equipment and cropping options are available to get us there.**

Tillage Considerations

- Every tillage pass breaks down soil structure and aggregates.
  - Good soil structure is important for water movement into the soil. The more water that goes into the soil, less runs off and is lost.
  - A well-structured soil allows more air in the soil to support root growth and soil life.
- When it comes to tillage, whoever makes the least passes wins.
  - Fewer passes leave more residue on the soil surface to protect from erosion, and also saves labour and fuel.
  - Design your tillage system to keep soil out of surface water.
- The tillage system must be economical.
  - Avoid excessive tillage. In many cases, tillage does not pay for itself in additional yield.
- The tillage system should be sustainable in the long term
  - Reducing organic matter levels and allowing the soil to erode is not sustainable.

Planter Considerations

- Let the planter or drill do a tillage pass.
  - Adding coulters to the planter or drill can save a tillage pass, or eliminate the need for tillage all together.
  - Trash whippers can remove residue from the row, reducing one or more tillage passes.
- Utilize a wide range of planter attachments to ensure good seed-to-soil contact.
  - Attachments are available to facilitate good seed placement.
  - Closing wheels are available to firm the seed in place.

Cropping Considerations

- Longer crop rotations are better.
  - Including a wide variety of crops will help increase organic matter levels, reduce pest problems and increase crop yields.
- Include cover crops as much as possible.
  - Cover crops can provide a wide variety of benefits, such as soil cover to protect against erosion, adding organic matter and improving soil structure.
- Manage residues at harvest.
  - Proper spreading of crop residues at harvest can reduce the need for tillage and avoid uneven soil drying in the spring.
- Winter wheat
  - No-tilling winter wheat into soybean or edible bean residue is the most profitable system, and provides the most soil cover.
- Soybeans
  - No-tilling soybeans into corn residue is the most profitable system, and provides the most soil cover.
- Corn
  - Reduced tillage and good residue management produces yields equivalent to moldboardplowing. This often costs less and provides more than 30% soil cover.
  - No-tilling corn after corn results in lower corn yields, although it provides the most soil cover.
  - Many growers successfully no-till corn after soybeans and cereal crops, while protecting the soil from erosion.

Wanted dead or alive! At least 30% soil cover 100% of the time.

Check Alfalfa Stands This Spring And Make A Plan

by Joel Bagg, Forage Specialist, OMAF and MRA

Low forage inventories and increasing risk for alfalfa winter kill makes assessing spring alfalfa health essential. Walking fields early this spring to determine alfalfa population; assessing if plants are dead or unhealthy or if the stand has thinned is a proactive strategy to maximize management options such as re-seeding. Deciding to manage a reduced stand, or replace it, can be a tough decision, but with tight forage inventories there isn't much room for ignoring the issue until you find yourself with a feed shortage. Don't wait until it is too late to implement useful options, such as timely reseeding in the rotation.

Alfalfa Winterkill Risk Factors

Although it is always difficult to predict alfalfa winterkill, there are some risk factors lining up for this spring.

- Alfalfa was stressed in 2013 with low yields.
- There was significant potato leafhopper damage across much of the province.
- Aggressive 4 cut systems are at a higher risk of winterkill and stand thinning than 3 cut systems.
- Cutting during the Critical Fall Harvest Period due to forage shortages
- Alfalfa prefers cool, dry fall weather for good winter hardening, but much of Ontario was wet into October and November.
- 2012-13 winter temperature fluctuations, melted snow followed by cold temperatures and some ice sheeting.
- Hopefully, we will not experience late-winter freeze-thaw cycles that result in alfalfa heaving.

(Refer to *Risk of Alfalfa Winterkill*
http://www.omafra.gov.on.ca/english/crops/facts/91-072.htm
Frost Damaged Alfalfa
http://www.omafra.gov.on.ca/english/crops/facts/frostdamaged.htm

Check your older fields, fields that are slow to green-up, poorly drained fields, fields with low fertility and pH, and fields that were aggressively cut last fall during the Critical Fall Harvest Period.

Plant Counts

Assessing whether to keep an alfalfa stand or not, can begin early spring at green-up after the plants have broken dormancy. Counting the number of plants (crowns) can give you an estimate of stand density. The limitation of using plant counts is that it doesn't account for the size of the crown or the number of stems potentially growing from each plant.

Alfalfa plant populations decline with age, but crowns get larger with more stems. Table 1 provides the minimum number of healthy plants per square foot for a desirable alfalfa stand. Mature stands (3rd year after establishment or older) should ideally have 3 or 4 plants/sq ft, but crown size and health should also be considered.

Table 1. Alfalfa Plant Count Guidelines (per square foot)

Stand Age	Good Stand	Consider Replacement
Seeding Year	25 – 40	< 15
1st year	> 12	< 8
2nd year	> 8	< 5
3rd year	> 6	< 4
4th year or older	> 4	< 3

Stem Counts

Stem density is the best indicator of yield potential from a stand. Initially, counting stems per square foot seems very tedious, but with some practice it can be done visually fairly easily and accurately. The limitation for measuring stem counts is that you can't do this until there is enough growth to count, about 4 – 6 inches. This may delay your decision and possibly the seeding date of resulting necessary new seedings. Like plant counts, stem count numbers assume no significant additional yield contribution from grasses. As a general rule, 55 stems per square foot provide a maximum yield. The critical level of **40** stems per square foot or less will result in a 25% yield reduction and should be rotated.

Dig & Check For Plant Health

It is very important to consider the health of alfalfa plants in addition to plant or stem densities. To properly assess forage stands you must inspect the field in several locations. This involves digging up plants with a shovel to get at least 6 inches of root. Look for large, symmetrical crowns with good leaf and bud vigour, and resistance to bark peeling. Lateral roots should be healthy and with good nodulation. (Figure 1) Using a sharp knife, slice the crown and root longitudinally. (Figure 2) Healthy plants will have a good internal root colour (white to cream colour) and firm in texture. Diseased plants will have dark brown, mushy areas of crown and root rot. Damage from disease get worse with time, not better. Dead or dying plants won't contribute to yield.

Cost of Reseeding Covered By Rotational & N Benefits To Corn Crop

Although there is sometimes a tendency to think planting new forage stands is expensive, it is relatively cheap considering potential yield losses in old stands and the benefits to the corn crop following in the rotation. Trying to squeeze an extra year out of a stand can be costly. New alfalfa stands reach maximum yields in the year following establishment. Yields gradually decline with age. By the third or fourth year, yields sometimes decline by 20 – 25%. That is a lot of lost hay yield that cannot be justified compared to the cost of shortening stand age by a year or two!

The recommended nitrogen (N) credit to a corn crop following alfalfa is 100 lbs N worth about $60 – 70. Research shows that there is also a yield benefit to corn following alfalfa of about 10 – 15%. Assuming 20 extra bu/ac at $5/bu, this is worth $100. Together, the N credit and rotation benefit goes a long way to covering forage establishment costs in another field in the rotation.

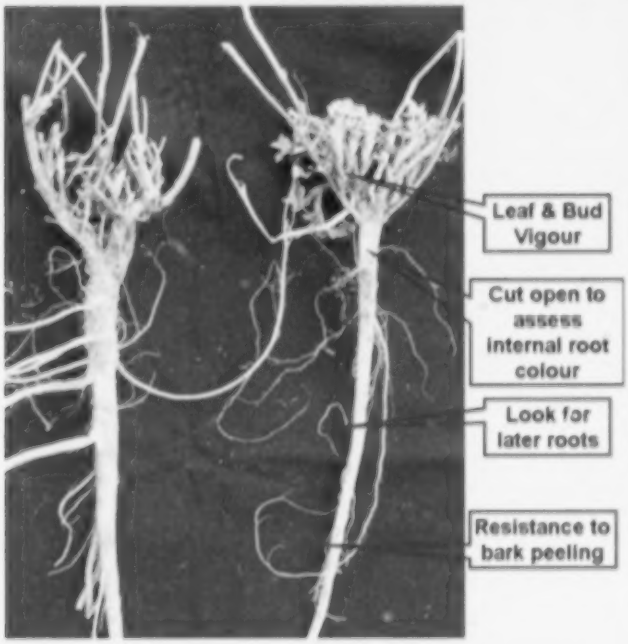

Figure 1 – Assessing alfalfa for plant health – things to look for. (Banks, OMAF/MRA)

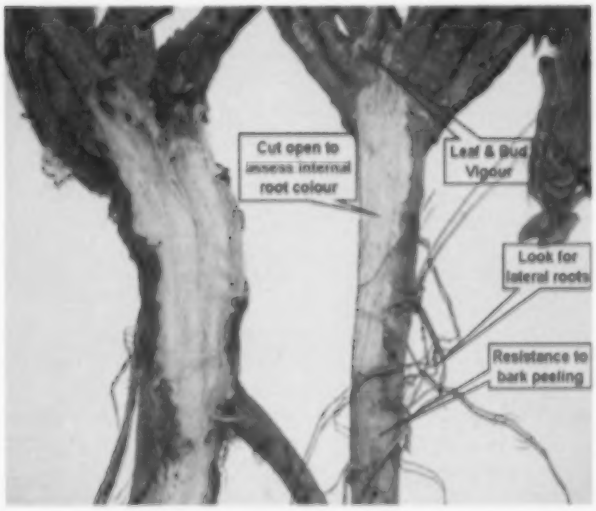

Figure 2 – Cut alfalfa crowns and roots to assess internal root colour and texture. (Banks, OMAF/MRA)

So You Took A Soil Sample...Fertilizer Recommendations and Approaches

By Bonnie Ball, Soil Fertility Specialist, OMAF and MRA

What Does A Soil Test Measure?

Not all of the soil nutrients are in a form available to a crop. The total amount is very large compared to the amount available, and in the end it does not relate to uptake, so there is no value in measuring it. **Available nutrient** amounts are estimated by using extractants.

When a soil sample goes to a laboratory, subsamples get mixed with chemical extractants that withdraw a portion of the total nutrient in order to approximate what is available to plants for uptake. Extensive research testing various chemical extractants has been done to determine those that most closely mimic plant uptake in our Ontario climate and soils. The OMAFRA accredited soil test extractants are:

- phosphorus (P) - sodium bicarbonate
- potassium (K) - ammonium acetate.

It is challenging for a lab test to determine the exact amount of P and K available over a growing season, because it is impossible to predict growing conditions. For example, P and K move very little in soil, so better root growth can enable plants to access more nutrients.

After soil is shaken with the extractant, the amount drawn out of the soil and into the liquid extract is determined using an analyzer. The extract analysis gives concentration in the liquid, which gets converted to weight of nutrient per weight of soil: milligrams nutrient per kilogram soil = **parts per million (ppm)**. This is the soil test value you see on your report.

Where Do Fertilizer Rate Recommendation Come From?

Fertilizer rate recommendations in the *Agronomy Guide for Field Crops* (OMAFRA Publication 811) are from measured crop responses (yield) to applied nutrients (application rates) in Ontario fields with varying soil test values determined by the accredited extractant. These recommendations can only be used if the OMAF/MRA accredited test is used to extract the soil. If a different extractant is used (eg. Bray), the nutrient concentration is different, and the OMAF/MRA tables do not apply.

OMAF/MRA fertilization recommendations are derived by using the "sufficiency approach". Table 1 compares this with other approaches for deciding how much fertilizer to apply, including the "build up and maintenance approach". Figure 1 illustrates the differences between these approaches. Decision-making "time frame" is a consideration in selecting which approach to use. For many operations, a rotation time frame may be appropriate. Nutrient applications from organic sources can easily be integrated into rotation-based fertility programs using NMAN3, http://apps.omafra.gov.on.ca/NMAN/NMAN3.html NMAN3 estimates crop removal over the rotation. Combined with regular soil testing, the system can be monitored over time to track whether the approach is sustainable.

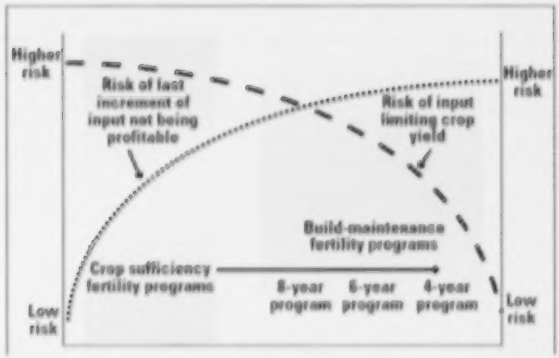

Figure 1. Sufficiency and build-maintenance approaches to fertilization (Leikam, Lamond, Mengel, 2003)

Sources

Eckert, D. J., McLean, E. O. 1981. Basic cation saturation ratios as a basis for fertilizing and liming agronomic crops: I. Growth chamber studies. Agronomy Journal 73: 795-799.

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Table 1—Approaches to making fertilizer recommendations

Philosophy	Rate	Time	Advantages	Disadvantages
Sufficiency (feed the crop) Maximize net returns to fertilizer investment in the year of application.	Most economic rate of fertilizer. Yield response in the year of application pays for cost of fertilizer.	Short term e.g. leased land, limited cash flow.	Low risk of over-fertilization (Figure 1).	Hinges on knowing critical soil test value, so more calibration data are required. Precise critical value depends on the season, soil, and crop. Annual fertilization is needed unless the soil test is high.
Build and maintain (feed the soil) Remove the nutrient as a yield-limiting factor.	At low soil test: apply> crop removal; build to > critical level. At medium to high:apply crop removal; maintain levels in adequate (to meet crop needs) range. At very high: no fertilizer, soil allowed to draw down.	Medium to long-term	Fertilizer not needed any given year; flexible; less calibration data needed.	Risk of over application (Figure 1); soils where freshly applied fertilizer is more available than residual.
Rotation Sustain production and the soil resource	Application targeted to specific crops or years in the rotation, based on crop responsive-ness, equipment, input costs e.g., apply to crop most responsive to freshly applied nutrient; row crop year with capability for sub-surface placement of P, which is more efficient; crop years with reduced fertilizer cost relative to crop revenue.	# years in the rotation	Better integration with organic nutrients; application when economics, weather are favourable.	Requires more information about the farming system. Owned or long-term land tenure.
Base cation saturation ratio (BCSR) Attain ideal ratio that maximizes crop production.	Range of ratios 65-85% calcium (Ca), 6-12% magnesium (Mg), 2-5% K	Medium to long term	Supporting data from subtropical weathered (old) soils. Excessive amounts of one nutrient can induce deficiencies of another.	In temperate (young) soils, favourable ratios do not exist (Footnote 1). In high pH soils, Cation Exchange Capacity, Ca and Mg are overestimated when acidic extractants are used to determine exchangeable cations (footnote 2). This alters the ratio and can trigger unnecessary applications. Only applies to cations. No economic analysis goes into the recommendations.

Footnote 1: Based on controlled studies, Eckert et al (1981) concluded that cation balance only matters at extremely wide ratios, where deficiencies of one element are caused by excesses of others. In 6 years of field studies by McLean et al (1983), correlations between yields and BCSR were low. They concluded that emphasis should be on providing sufficient, but non-excessive levels of each basic cation, rather than attempting to attain a ratio.

Footnote 2: High pH soils with prevalent carbonates are common in some areas of Ontario. The acid e.g. in Mehlich extract, solubilizes Ca and Mg carbonates. This causes some Ca and Mg to be included as exchangeable, which actually are not. CEC is overestimated because it is calculated from the sum of Ca + Mg + K. Actual CEC is measured using a different chemical.

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